Swelling Correction to Magnetic Suspension Balance Solubility Measurements of CO_2 / Polymer Systems at High-Pressure

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The magnetic suspension balance (MSB) method is a standard method for the determination of gas solubility in polymers at low pressures. At high pressures, the effect of buoyancy becomes significant in determination of solubility. The buoyancy effect in turn depends on the volume change of the polymer due to swelling caused by CO_2 absorption. The MSB does not allow a direct visual determination of swelling effect. In this work several approaches are proposed to improve swelling correction of MSB data. One assumes the polymer density does not change due to CO_2 absorption, while and the other calculates this change based on the PC-SAFT equation of state. Using these approaches, high pressure carbon dioxide solubility measurements were analyzed for acrylic polymers. The PC-SAFT approach proved to be an excellent method to determine the trends in carbon dioxide solubility in polymers at high pressure. However the solubility values generated with this method at high pressures and low temperatures were found to be higher than those reported in the literature. The combination of these two approaches provides sufficient information for polymer selection based on carbon dioxide solubility needed in several industrial applications.